NUCLEAR ENERGY RESEARCH INITIATIVE

Experimental Verification of Magnetic Insulation for Direct Energy Conversion Fission Reactors

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Collaborators: Texas A&M University; General Atomics

This project will investigate the feasibility of direct energy conversion by designing, building, and testing prototype cells with advanced magnetic isolation and insulation technologies.

This research will establish the feasibility of developing reactors that directly capture the energy of nuclear fission fragments to produce electricity. With no intermediate conversion to thermal energy, the efficiencies of such reactors are not subject to classical thermodynamic limitations. The potential maximum efficiency of a direct energy conversion reactor is approximately 50 percent and is independent of temperature. As high temperatures and pressures are not required, large safety margins and passively safe design should be achievable. These advantages, combined with integral power conversion and modular design, present an opportunity to develop a low-cost reactor system.

Concepts to achieve direct energy conversion of fission fragments were investigated during the 1950s and 1960s. Experiments demonstrated the basic physics of the concept, but technical shortfalls prevented the attainment of operational goals. Magnetic solenoids required to capture the fission fragments and insulators to withstand high voltage gradients due to capture did not exist. Dramatic improvements in relevant technological disciplines have occurred since this time, including magnetic and insulation development, and are directly applicable to this direct energy conversion project.